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Exemption No. 8323

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
KANSAS CITY, MISSOURI 64106

In the matter of the petition of	*	
	*	
Cessna Aircraft Company	*	Regulatory Docket No. FAA-2004-17317 -5
	*	
for exemption from § 23.181(b) of Title 14 of the Code of Federal Regulations (CFR)	*	

GRANT OF EXEMPTION

By letter dated March 5, 2004, Mr. Wendell Corneil, Cessna Aircraft Company, Post Office Box 7704, Wichita, KS 67277, petitioned for exemption from compliance with § 23.181(b) of Title 14, Code of Federal Regulations (14 CFR) for the Cessna Model 525B, CitationJet III and to allow Cessna to show compliance to § 25.181(b) for the 525B instead. This request for exemption is similar to one received for FAA Exemption 5759, which was granted for the 525 CitationJet in October 1993 and later extended to the 525A CitationJet II in June of 2000. The 525B is a derivative of the 525 and 525A, listed on Type Certification Data Sheet No. A1W1.

This exemption, like Exemption 5759, allows the Cessna 525B CitationJet III to show compliance with the appropriate level of positive lateral directional dynamic Dutch Roll stability, according to the intent of § 25.181(b), solely by aerodynamic means if a yaw damper fails. This exemption increases the acceptable number of cycles allowable to damp the Dutch Roll response from 7 cycles, required by § 23.181(b) to 13 cycles to reach $1/10^{th}$ amplitude. It clearly defines the positive damping requirements for the 525B to meet the intent of the certification requirements.

This exemption also includes a limitation to prohibit the 525B from flight above 30,000 feet without an active yaw damper. This limitation is justified by the difference in the stability characteristics of the Cessna 525B, when compared with the 525 and 525A. For points below 30,000 feet, flight test data has shown that the 525B meets the intent of the terms of Exemption 5759, which was granted for the 525 and 525A and the intent of § 25.181(b). Below 18,000 feet, this exemption requires the 525 series of airplanes to meet the intent of § 23.181(b), where the Dutch Roll damps to 1/10 amplitude in 7 cycles.

The petitioner requires relief from the following regulation(s):

Cessna petitioned the FAA to allow an amendment to the model 525B type certification basis to use the directional-stability damping criterion of § 25.181(b) instead of the damping criterion of § 23.181(b). Section 23.181(b) of 14 CFR, part 23 requires that any combined lateral-directional

oscillations ("Dutch Roll") occurring between the stalling speed and the maximum allowable speed appropriate to the configuration of the airplane must be damped to 1/10th amplitude in 7 cycles with the primary controls free and in a fixed position.

In contrast, § 25.181(b) of 14 CFR requires that any combined lateral-directional oscillations ("Dutch Roll") occurring between 1.13 V_{SR} and the maximum allowable speed appropriate to the configuration of the airplane must be positively damped with the controls free. It must also be controllable with normal use of the primary controls without requiring exceptional pilot skill.

The petitioner supports the request with the following information:

The petitioner asserts that the 525B is a derivative model of the 525 and 525A and has similar stability characteristics to the other models. For the 525 model, Exemption 5759 was granted in October 1993 allowing an exemption from 14 CFR, § 23.181(b). Exemption 5759 was later extended to include the Cessna Model 525A in June 2000. The petitioner asserts that Exemption 5759 should also apply to the Cessna 525B, with the additional restriction to descend below 30,000 feet if a yaw damper fails. This added restriction maintains the original intent of Exemption 5759, which requires any combined lateral-directional ("Dutch Roll") oscillations damp to 1/10th amplitude in 13 cycles or less for all the 525 and 525 derivative models if a yaw damper system fails.

The petitioner also supplied flight test data, on record with the responsible Aircraft Certification Office (ACO), which substantiates that below 30,000 feet, the 525B has similar lateral stability characteristics to the Cessna 525 and 525A models. All of the Cessna 525 models have exhibited an exemplary service history and have no record of lateral control issues in service.

Comments on published petition summary:

A summary of this petition was published in the FEDERAL REGISTER for public comment on April 26, 2004 (69 FR 22588). The comment period closed on May 17, 2004, and the FAA did not receive any comments regarding this petition.

The Federal Aviation Administration's (FAA) analysis is as follows:

The combined lateral-directional oscillation mode, or Dutch Roll mode, is a well-understood phenomenon of aerodynamic stability for small airplanes and is a function of wing sweep angle, wing dihedral angle, vertical tail size, vertical tail moment arm, and other basic design characteristics. Handling qualities research has shown that Dutch Roll stability has a large impact on pilot workload.

14 CFR, § 23.181(b), requires that all Dutch Roll oscillations be damped to 1/10th amplitude in 7 cycles. The FAA has determined that the current part 23 standards are appropriate minimum standards for typical part 23, single pilot airplanes. This basic stability requirement is driven by the desire for small airplanes to exhibit acceptable handling qualities for single pilot operations, particularly in Instrument Meteorological Conditions (IMC) and in turbulence. For part 23, these

requirements are frequently met solely by aerodynamic means. Few small airplanes have been certified with automatic yaw damping stability augmentation systems.

However, as airplanes are designed to operate at higher speeds and higher altitudes, it becomes difficult to balance the design characteristics so the airplane can meet the basic stability requirements of § 23.181(b) and still achieve high speed cruise efficiency and performance. As a result, nearly all small business jets and transport category airplanes are type certificated with automatic yaw damping stability augmentation devices to meet positive lateral-directional stability requirements.

Because of the emerging small jet market, the FAA expects to see an increasing number of high altitude/high performance airplanes in part 23 that will probably need to incorporate a yaw damper to meet certification requirements. These systems help retain good ride quality characteristics for passenger comfort and safety, particularly for swept wing airplanes.

In contrast, the part 25 requirements specify only that the characteristics be positively damped. However, "positively damped" does not adequately define the characteristics that a part 23 airplane needs to exhibit. Single pilot operations, especially in IMC, necessitate a higher Dutch Roll damping ratio for pilot workload considerations. Therefore, the FAA has determined for the Cessna 525 series, "positively damped" means all Dutch Roll oscillations must damp to $1/10^{th}$ amplitude in 13 cycles or less.

Some existing aircraft can meet the Dutch Roll damping requirements at lower altitudes, but not at their design cruising altitudes, particularly swept wing airplanes. For these airplanes, the FAA has allowed continued operation after a yaw damper failure provided the airplane is operated at or below the altitude where it can meet the damping requirements. This has been allowed provided that it is adequately addressed in the Airplane Flight Manual (AFM). For the Cessna 525B, an operational limitation will be added to the AFM to require the airplane to descend below 30,000 feet if a yaw damper fails. Doing so ensures that the 525B stability requirements meet the intent of the original exemption granted for the 525 and 525A.

The following items are presented in support of this exemption.

1. The Cessna 525B can operate at 41,000 feet, requires the pilot to be type rated, and is operated as an airplane type certificated with a yaw damping system.
2. Cessna flight tests show that the 525B exhibits no unsafe condition or characteristic after a yaw damper failure.
3. The predecessors to the Cessna Model 525B, the Cessna Citation 500 series airplanes, were certificated to part 25 standards and still operate without the requirement for an operational yaw damper.
4. The Cessna Citation 500 series airplanes were awarded the Collier Trophy in 1985 for an outstanding safety record and still exhibit an exemplary service record.
5. An operational autopilot is required to fly the Cessna Model 525B with a single pilot, which reduces pilot workload.

To obtain an exemption, the petitioner must show, as required by 14 CFR, part 11, § 11.25(b)(5), that: (1) granting the request is in the public interest, and (2) the exemption would not adversely affect safety, or that a level of safety will be provided equal to that provided by the rule from which the exemption is sought.

In consideration of the foregoing, I find that granting this exemption is in the public interest and will not adversely affect safety. Therefore, pursuant to the authority contained in 49 USC, §§ 40113 and 44701, as amended, delegated to me by the Administrator (14 CFR, part 11, § 11.53), the petition of Cessna Aircraft Company, for exemption from 14 CFR, part 23, § 23.181(b) is hereby granted for the Cessna Model 525B. This exemption is granted with the following limitations and conditions:

1. To be consistent with Exemption 5759, which was granted for the 525 and 525A, this exemption for the 525B requires that all combined lateral directional oscillations ("Dutch Roll") occurring between the stalling speed and the maximum allowable speed appropriate to the configuration of the airplane must be damped to 1/10 amplitude in 13 cycles with the primary controls free and in a fixed position for operations above 18,000 feet. The current standards in § 23.181(b) will still apply to the 525B below 18,000 feet.

2. Since the 525B cannot meet the above condition for operations above 30,000 feet, an additional limitation will be added to the AFM for the Cessna Model 525B to restrict operation to below 30,000 feet altitude if the yaw damper fails.

3. An FAA pilot evaluation must be made to verify that no unsafe condition exists with the airplane's handling characteristics with the yaw damper disabled. These evaluations must include a typical approach, landing, and takeoff with the yaw damper disabled. Also, a pilot evaluation must be made to verify that no unsafe condition exists during the descent from 41,000 feet to below 30,000 feet with the yaw damper disabled. At least one Aircraft Certification test pilot and at least one Aircraft Evaluation Group (AEG) pilot should conduct these evaluations.

Issued in Kansas City, Missouri on June 16, 2004.

William J. Timberlake
Acting Manager, Small Airplane Directorate
Aircraft Certification Service